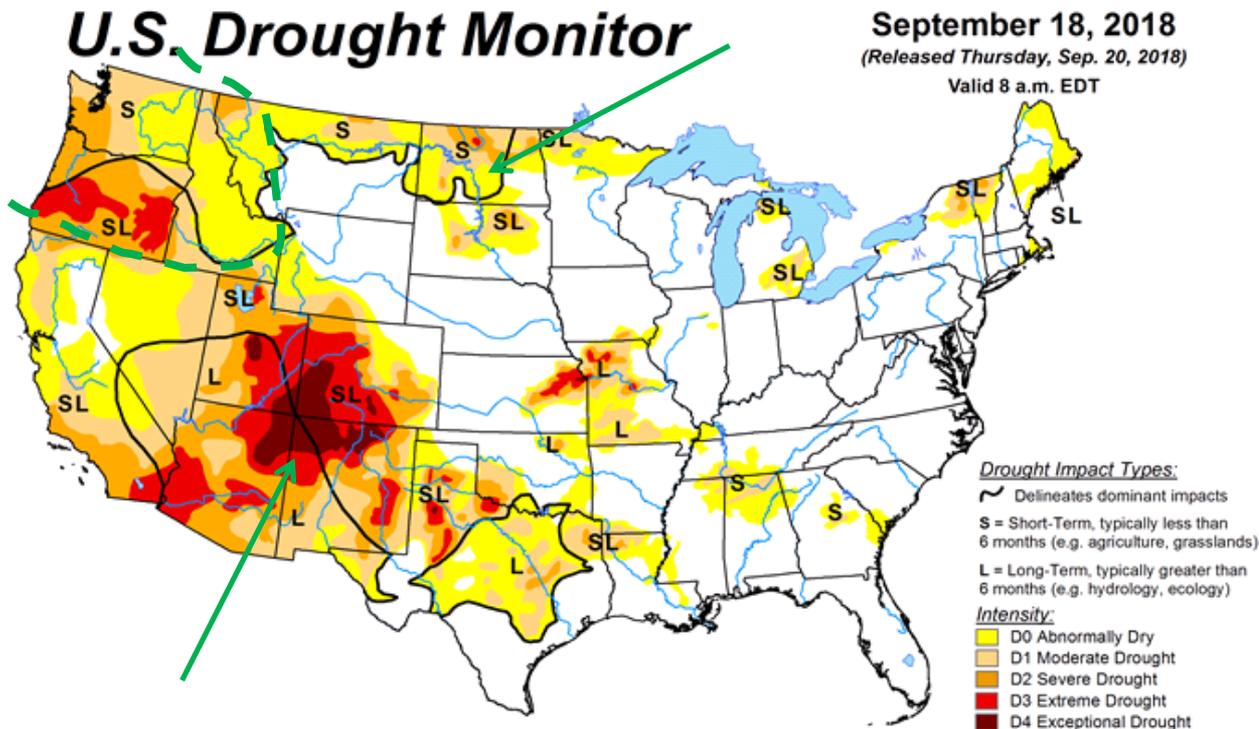


The Evolution and Status of The Northern High Plains Drought & The Ongoing Southern Drought

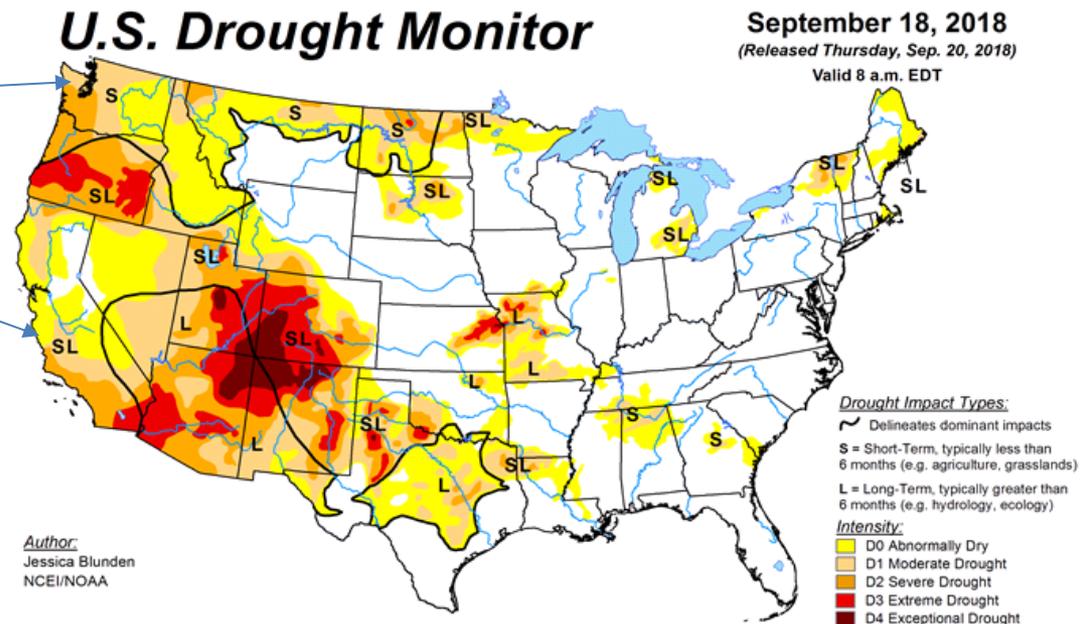


Muthuvel Chelliah
Climate Prediction Center
NCEP/NWS

Drought – no single unique definition that is acceptable to all communities. In terms of definition and impact, it means different things to different people.

Different kinds of droughts (but with varying definitions!)

- Meteorological drought
 - Agricultural drought
 - Hydrological drought
 - *(Socioeconomic drought)*
 - *(Ecological drought)*.
-
- But in CPC/drought monitor and outlook world, we only have Short/Long Term Drought denoted by S/L



2017 NORTHERN PLAINS DROUGHT ASSESSMENT

National Integrated Drought
Information System
Drought.gov

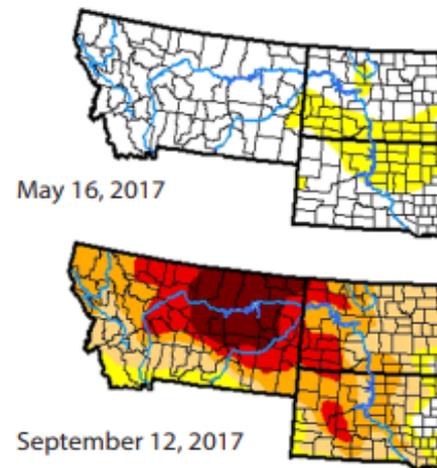


March 19,
2018

The Northern Plains drought started in the spring and summer of 2017 and sparked widespread wildfires and compromised water resources, leading to the destruction of property, livestock losses, and reduced agricultural production. These impacts were felt in South Dakota, North Dakota, Montana, by the tribes of the Northern Plains, and in the Canadian Prairies. The total estimated cost of the drought in the region was \$2.5 billion.

A drought snapshot: what happened in 2017?

The 2017 drought developed quickly. In early May, the US Drought Monitor reported no drought in the region. By the end of the month, moderate (D1) drought began to develop in North and South Dakota. Over the course of just four weeks, from the beginning to the end of June, moderate, severe, and extreme drought (D1-D3) had spread across the Dakotas and into Montana. Exceptional Drought (D4), the most severe category, first appeared in North Dakota and Montana on the Drought Monitor on July 18, 2017. One week later, drought had spread to cover about 80% of both South Dakota and North Dakota, and most of the eastern half of Montana. While autumn brought some relief to the region, areas in all three states are still under a severe drought classification as of February 15, 2018.



“Over the course of just four weeks, from beginning to end of June (2017), moderate, severe and extreme drought (D1-D3) had spread across the Dakotas and into Montana”

► **Fig. 1.** U.S. Drought Monitor maps showing the rapid development of the 2017 drought.

Intensity:

■ D0 Abnormally Dry ■ D3 Extreme Drought
■ D1 Moderate Drought ■ D4 Exceptional Drought

The sudden Onset of the current 2017 Northern High Plains Drought
Muthuvel Chelliah and David Miskus
Climate Prediction Center/NCEP/NWS, College Park, MD



What Happened? and
Lessons Learned!!

If some of you may have to ask, What
Happened? "What Happened?" 😊
Then you need to catch up 😊. I will explain!!

SUMMARY

(from Last October! Last Year's CDPW presentation)

What Happened? (Northern Plains Drought) :

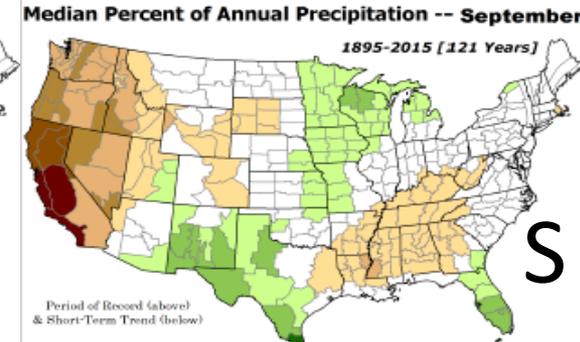
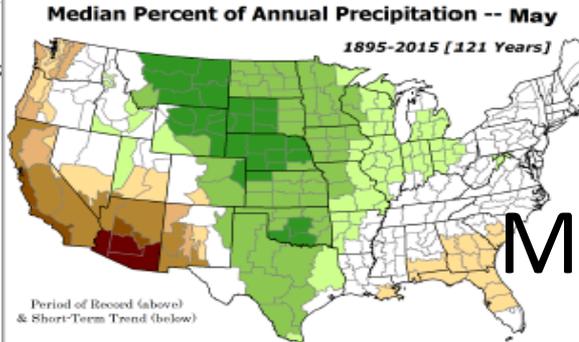
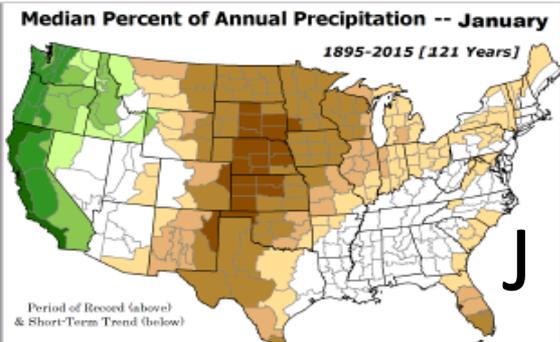
- The Northern Plains Drought was successfully forecast!!
- BUT, Could the Drought have been addressed/caught early ? - YES!
- Was the accruing Precip deficit in the Dakotas/Montana recognized a bit late? – YES!
- Did we put too much trust on the model's/official rainfall forecast? – YES!

Lessons Learned: (all the Implications from above, “what happened?”)

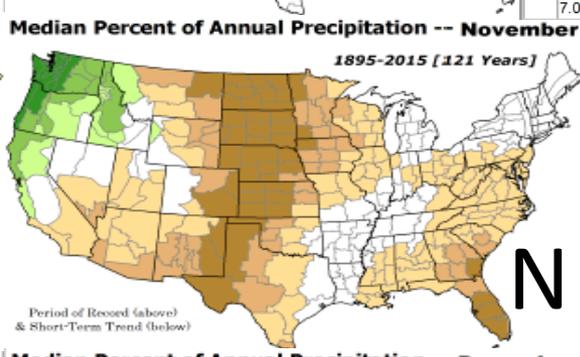
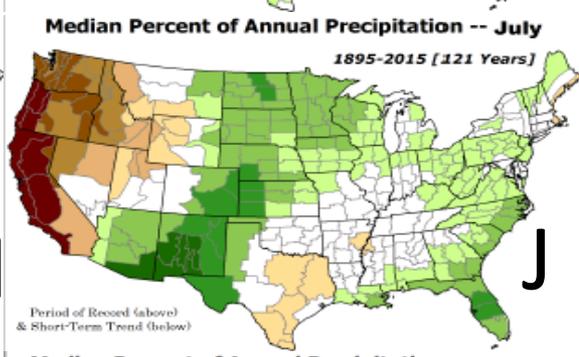
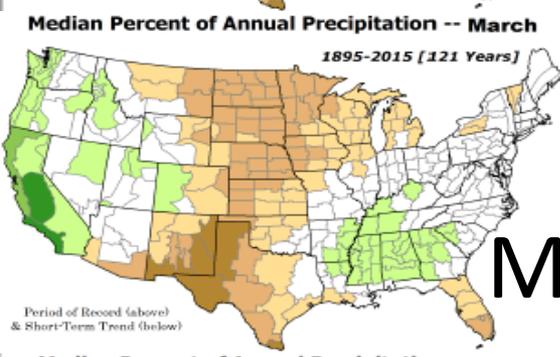
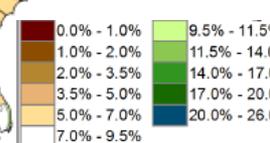
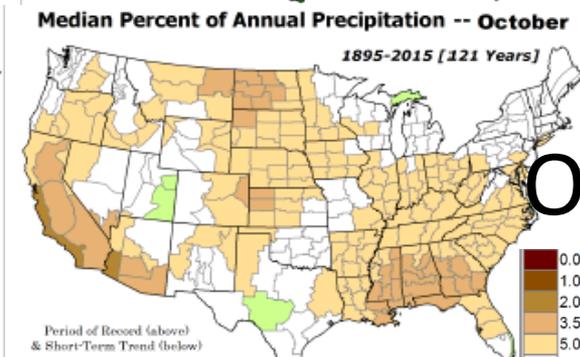
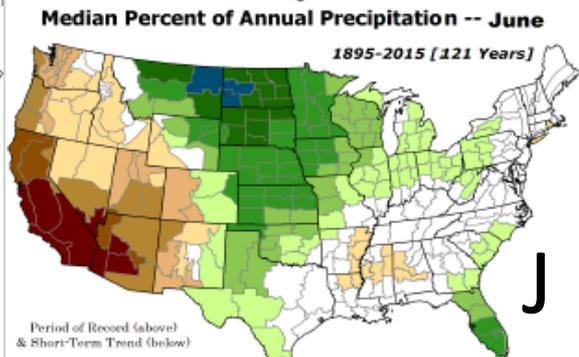
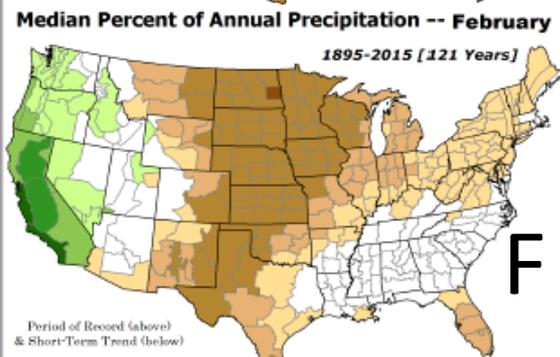
- So, unlike flash floods, which can happen in a matter of days, and can be forecast ahead of time to a certain extent, all Droughts have to develop from week after week, month after month, precipitation deficit, accrued deficit of rainfall/ soil moisture conditions!
- That too depends on WHERE? & WHEN? Does the region have a limited-months-only rainfall season? Such as California/WA/OR/Northern Plains/Florida ? Then the accrued rainfall deficit is critical, and must be watched carefully!
- So, until such time our (models'/official) rainfall forecasts improve to be more reliable and useful, existing/accrued P/SM deficits combined with realistic/cautious evaluation of whatever Precip probability outlook, taking into account the rainfall seasonality in the region, may give us the best guidance of drought outlooks. Will have to develop/issue drought development probability based on existing dryness and precip forecast probability!!!

Three Main factors in being able to assign/declare drought in a region and be able to forecast:

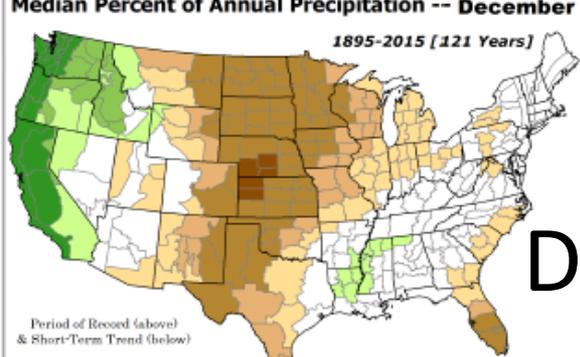
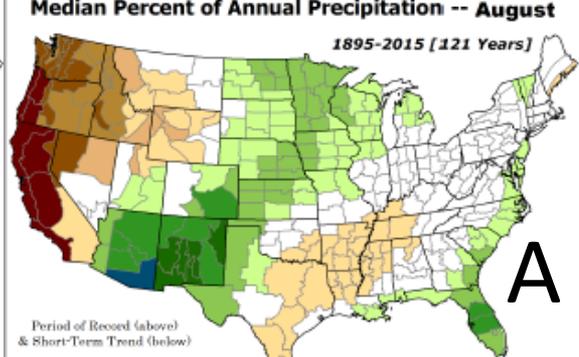
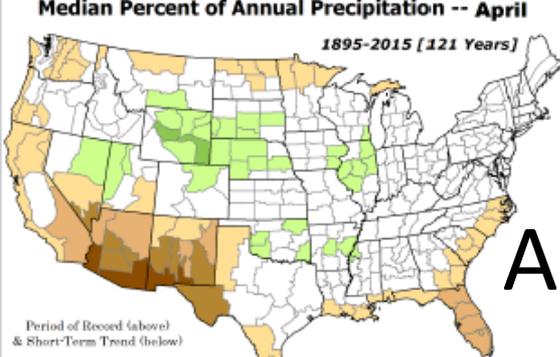
- Keep watching regularly (every week!) the accrued/Accumulated Precipitation deficit in a given region over a continuous period ranging from weeks/month/seasons. 
- Put this deficit in the context of what the climatological rainfall season is for that region!! Is it a limited few months of the year, or is it more or less spread through out the year? When Is the rainfall deficit occurring? 
- Future Rainfall/Temperature/Soil Moisture Forecast and its reliability!!!!!!!! 



For Summer Drought Watch closely Spring time deficits!!



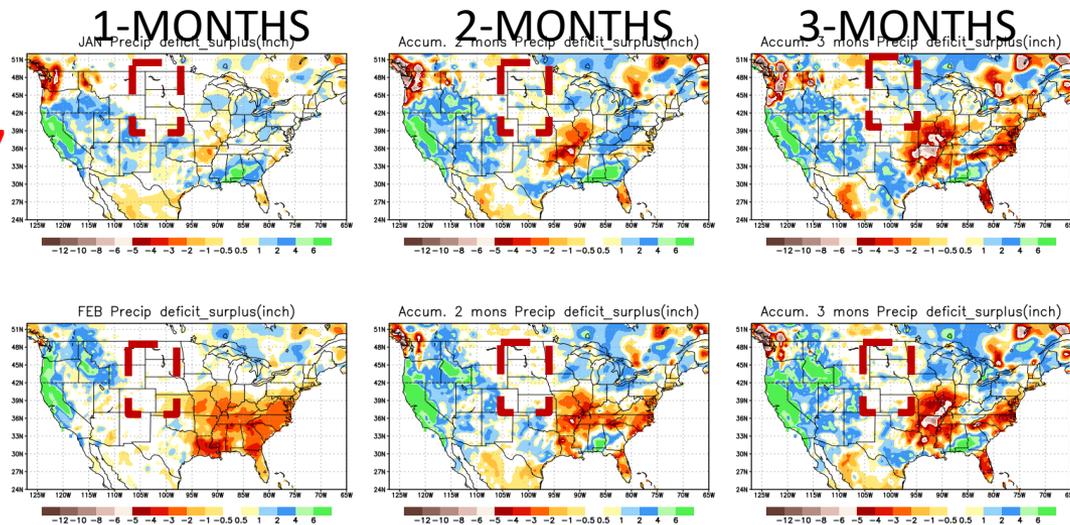
Monthly Median % Of Annual Precep!



Adapted from [California](#) Rich Tinker.

1mon, 2mon, 3mon
Ending Accum. Precip
Deficit (yellow/red)
Surplus (blue/green)

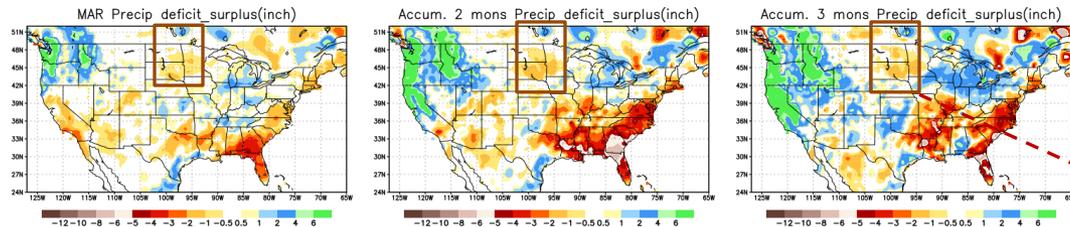
Jan
2017



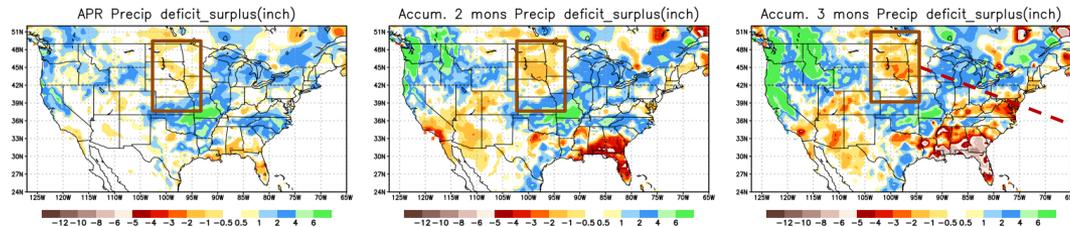
Feb

Accrued
Precip.
Deficit/
Excess

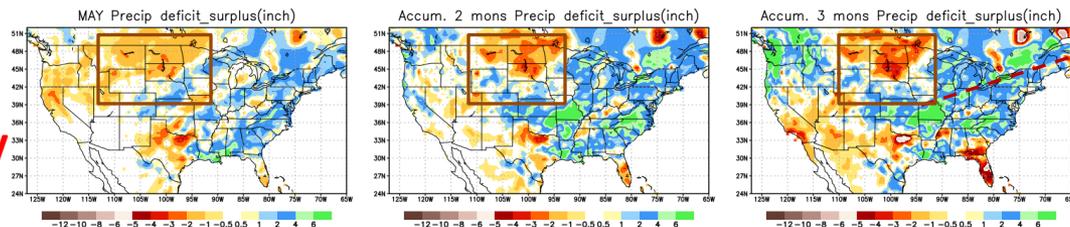
Mar



Apr

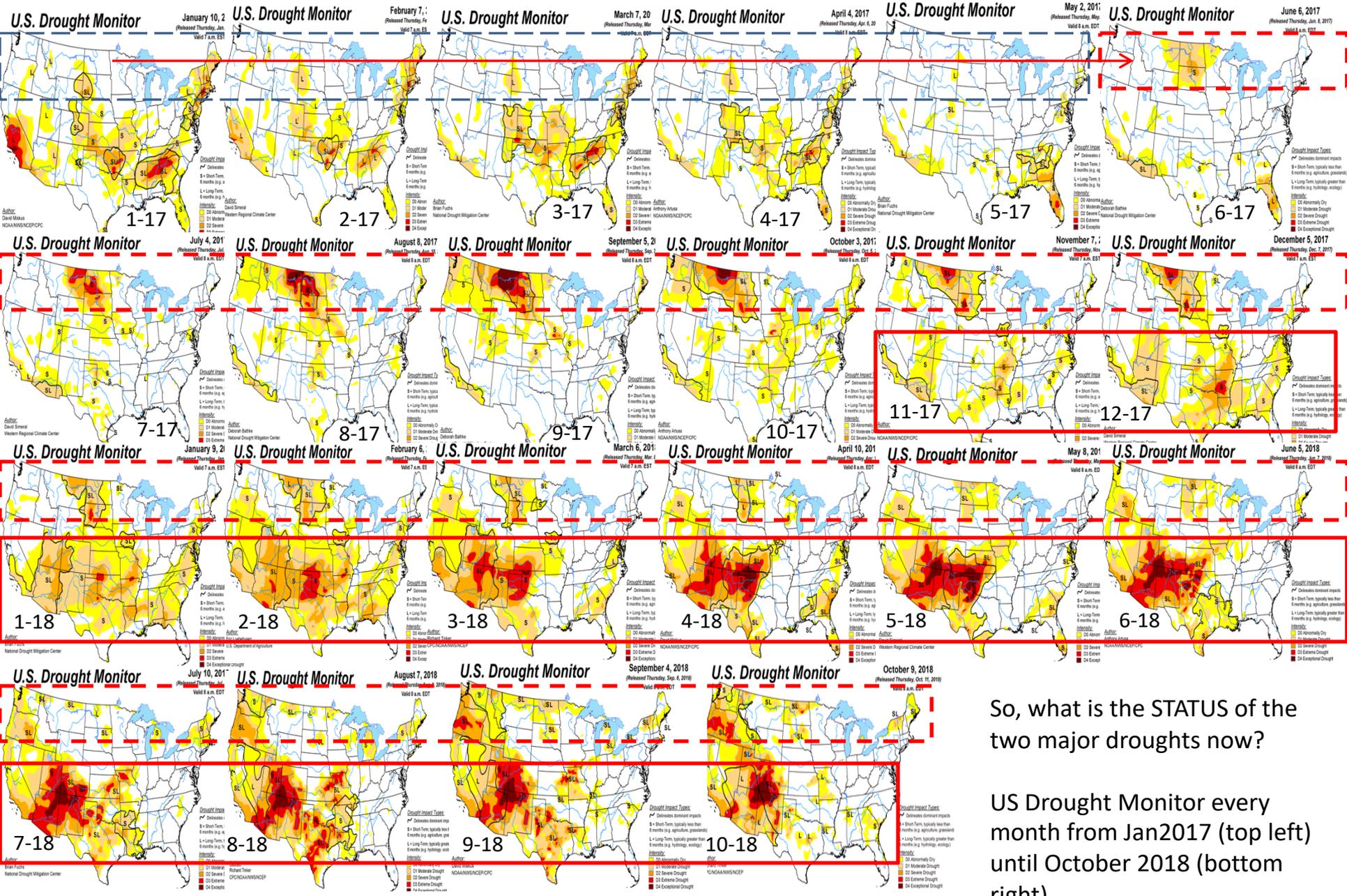


May



Early in 2017, the focus is still on the CA drought ending, and on the drought in the southeast. There were no signs of drought in the Northern Plains. In fact, there was even good snow.

Early signs of developing dryness/drought in the Northern Plains were pretty clear at the end of March (first in South Dakota), definitely in April, and firmly/fully established in May, after missing the expected rainfall in May, the first full month of the three month rainy season MJJ !!



So, what is the STATUS of the two major droughts now?
 US Drought Monitor every month from Jan2017 (top left) until October 2018 (bottom right)



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Cold & Warm Episodes by Season



Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2010	1.5	1.3	0.9	0.4	-0.1	-0.6	-1.0	-1.4	-1.6	-1.7	-1.7	-1.6
2011	-1.4	-1.1	-0.8	-0.6	-0.5	-0.4	-0.5	-0.7	-0.9	-1.1	-1.1	-1.0
2012	-0.8	-0.6	-0.5	-0.4	-0.2	0.1	0.3	0.3	0.3	0.2	0.0	-0.2
2013	-0.4	-0.3	-0.2	-0.2	-0.3	-0.3	-0.4	-0.4	-0.3	-0.2	-0.2	-0.3
2014	-0.4	-0.4	-0.2	0.1	0.3	0.2	0.1	0.0	0.2	0.4	0.6	0.7
2015	0.6	0.6	0.6	0.8	1.0	1.2	1.5	1.8	2.1	2.4	2.5	2.6
2016	2.5	2.2	1.7	1.0	0.5	0.0	-0.3	-0.6	-0.7	-0.7	-0.7	-0.6
2017	-0.3	-0.1	0.1	0.3	0.4	0.4	0.2	-0.1	-0.4	-0.7	-0.9	-1.0
2018	-0.9	-0.8	-0.6	-0.4	-0.1	0.1	0.1	0.1				

- In the last 7-8 years, there were more cold events/La Ninas, which were generally associated with dryness(lack of precip) over the US.
- Moreover, the 2015 warm event/El Nino, did not produce the expected precip impact over CA/southwest, thus leading to a net accrued precipitation deficit.
- -thus contributing to the overall dry conditions in the south/southwest and even in the northern plains!! – the two current areas of drought under study!

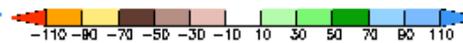
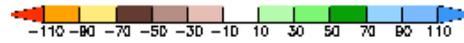
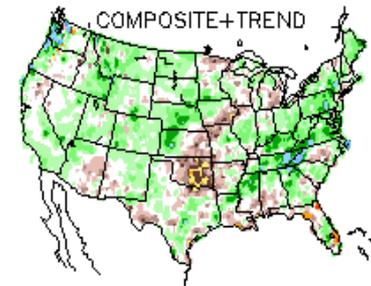
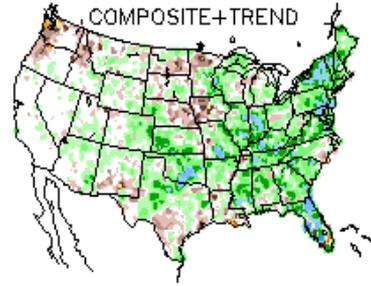
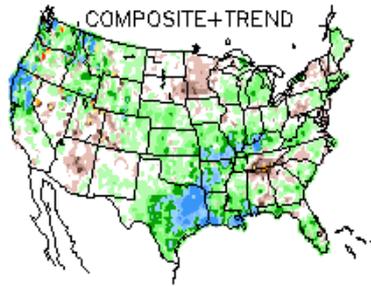
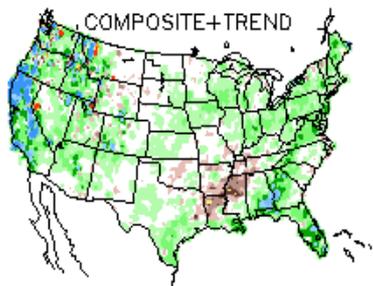
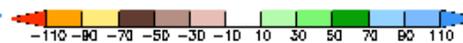
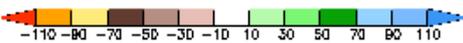
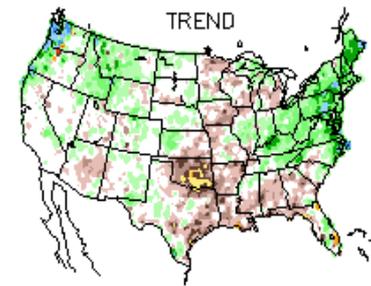
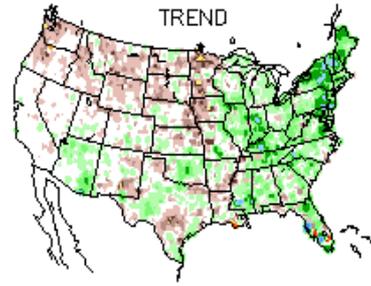
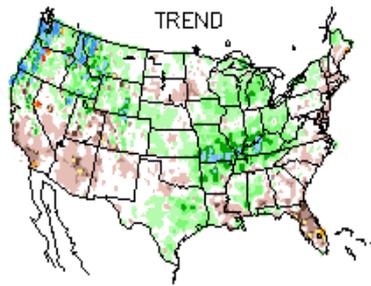
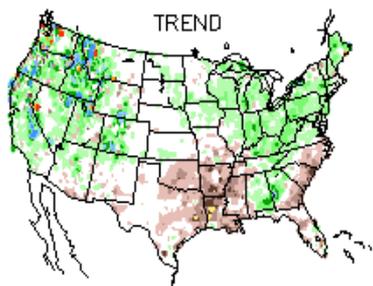
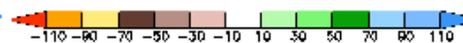
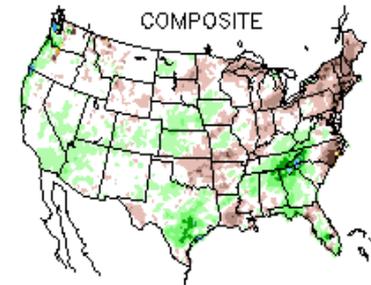
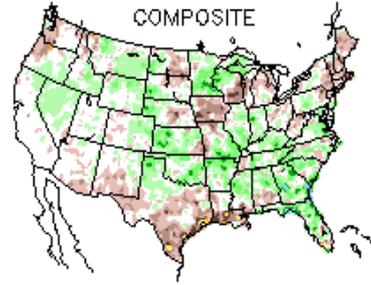
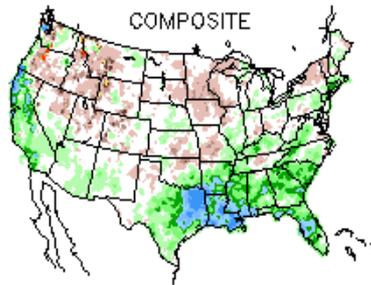
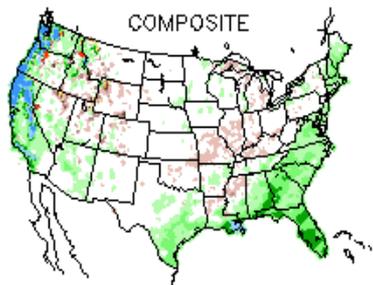
EL NINO Precip COMPOSITES

DJF ANOMALIES

MAM ANOMALIES

JJA ANOMALIES

SON ANOMALIES



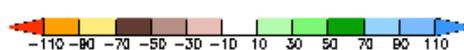
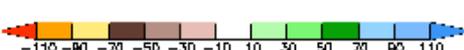
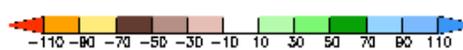
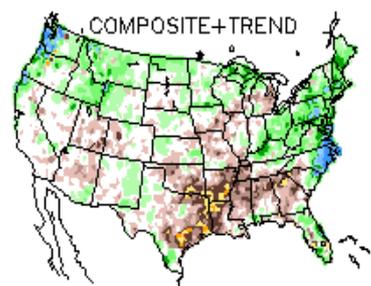
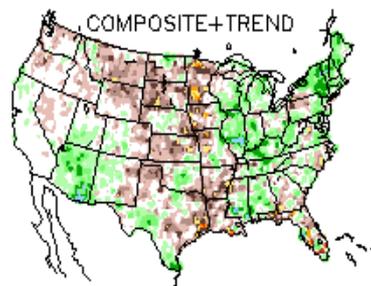
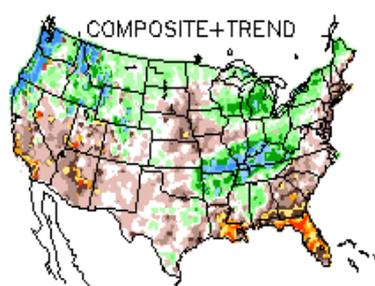
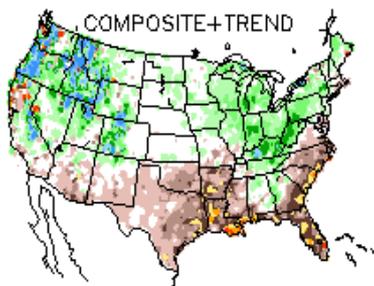
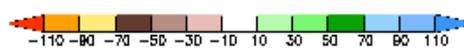
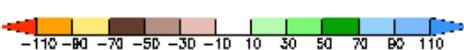
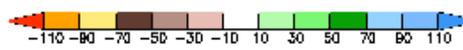
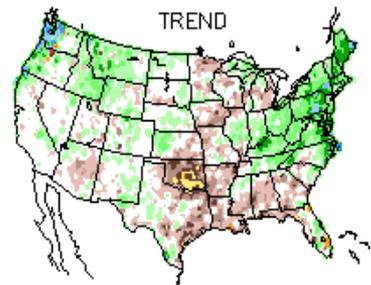
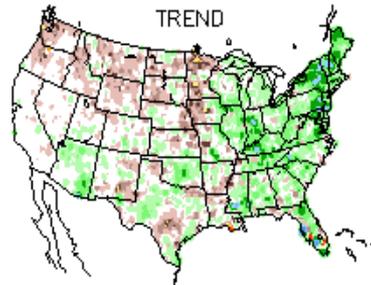
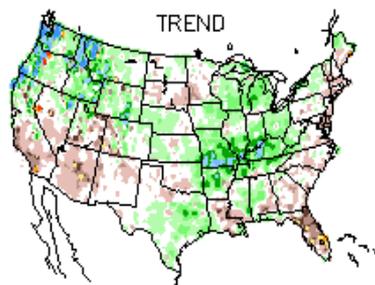
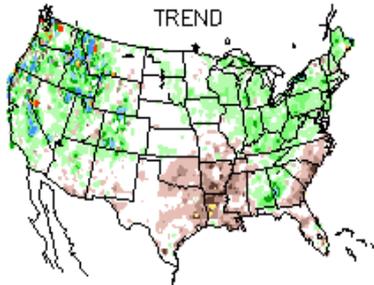
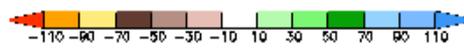
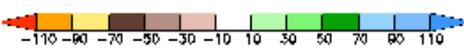
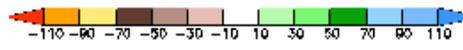
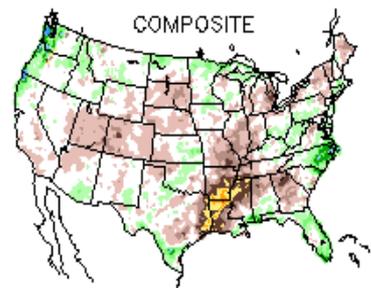
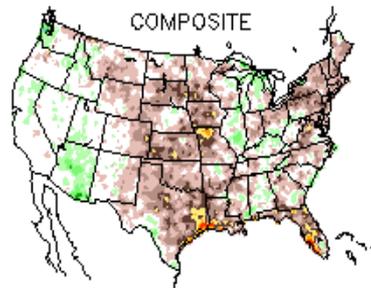
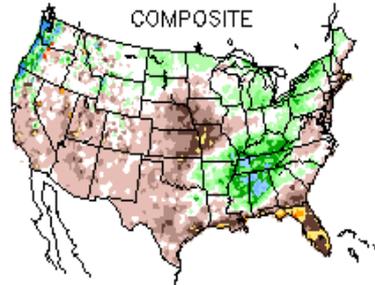
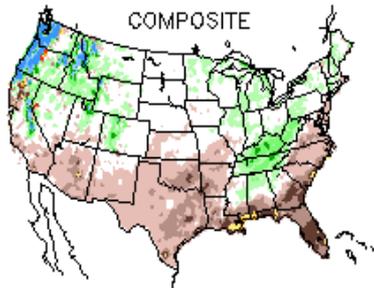
LA NINA Precip COMPOSITES

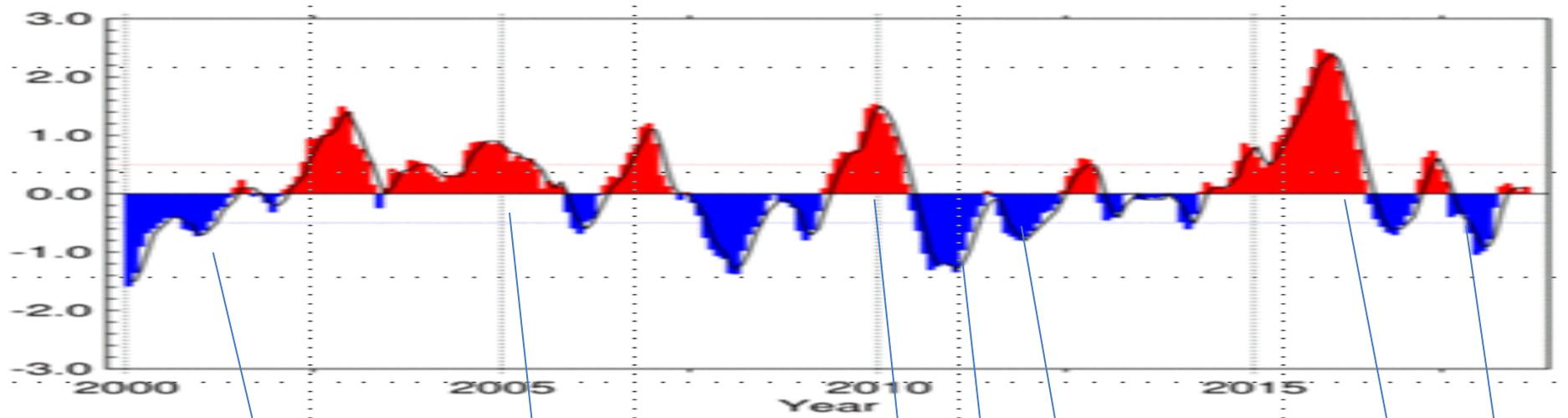
DJF ANOMALIES

MAM ANOMALIES

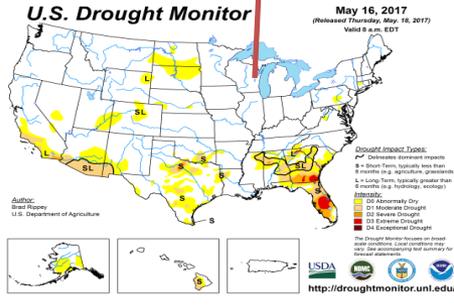
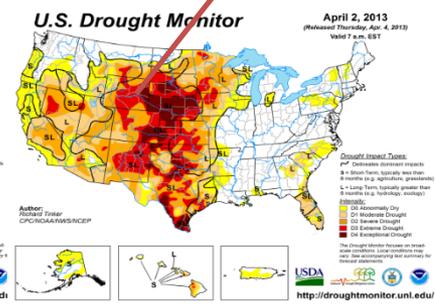
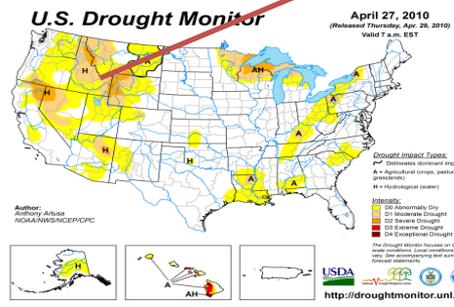
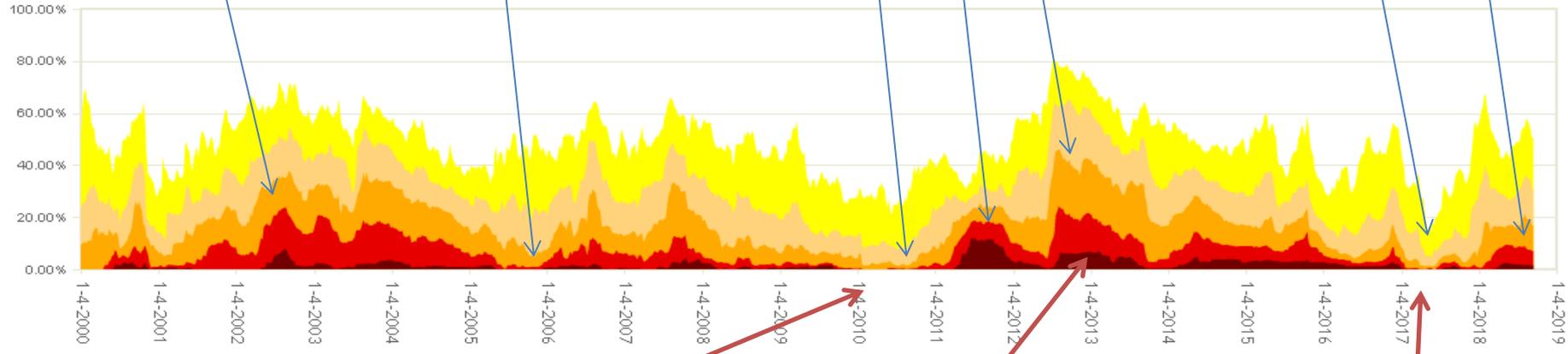
JJA ANOMALIES

SON ANOMALIES





Continental U.S. (CONUS) Percent Area



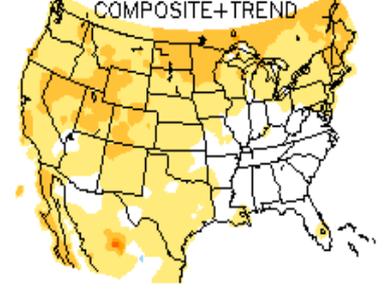
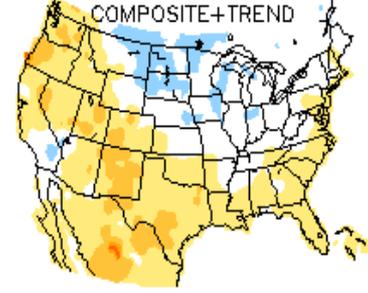
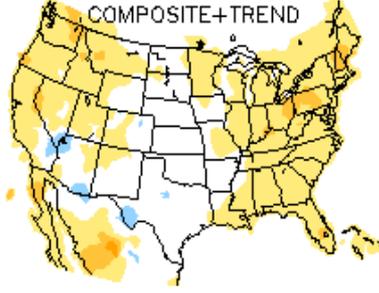
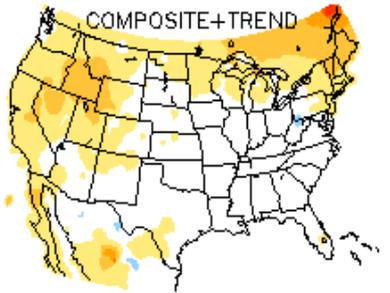
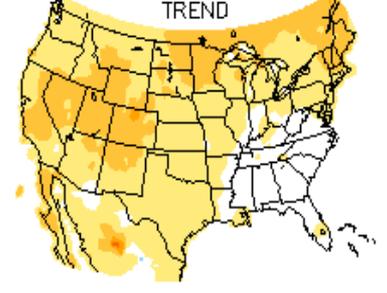
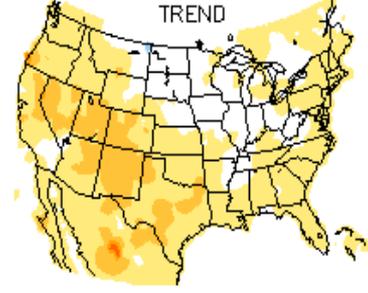
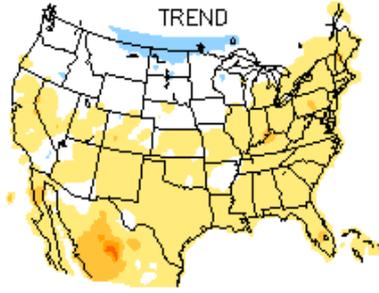
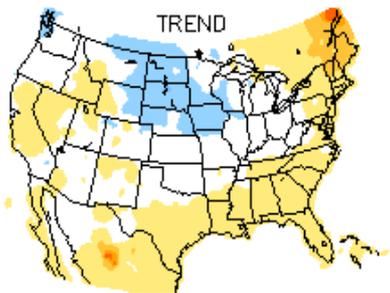
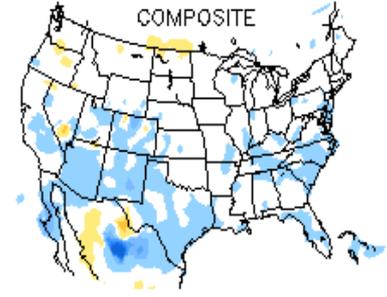
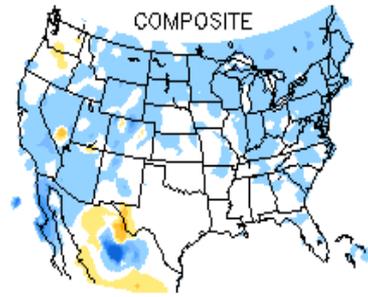
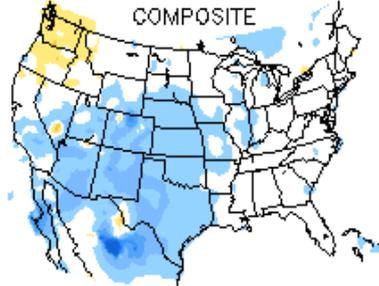
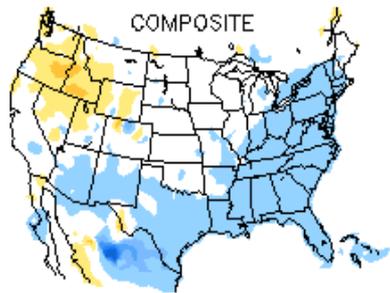
EL NINO Temperature COMPOSITES

DJF ANOMALIES

MAM ANOMALIES

JJA ANOMALIES

SON ANOMALIES



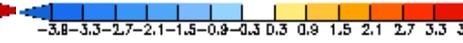
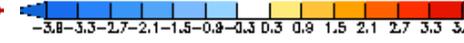
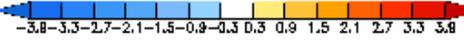
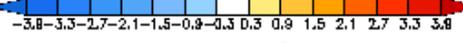
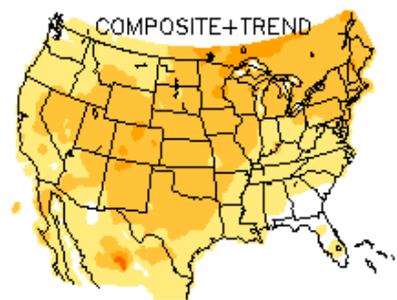
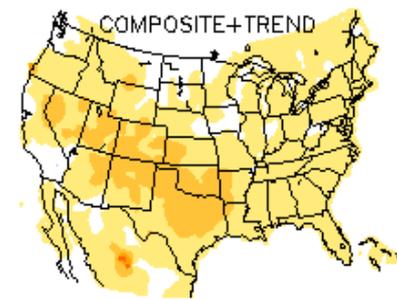
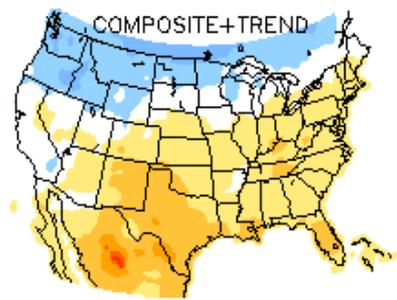
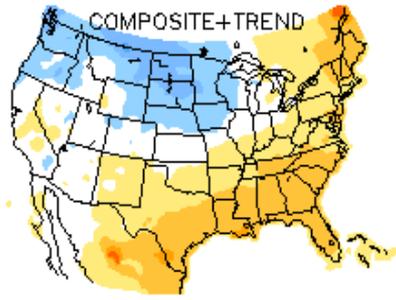
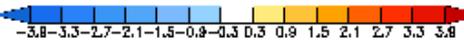
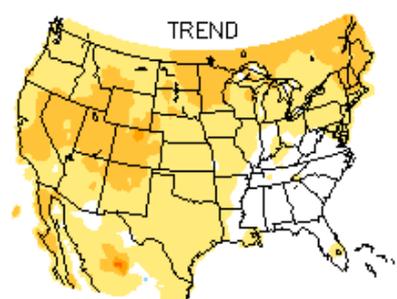
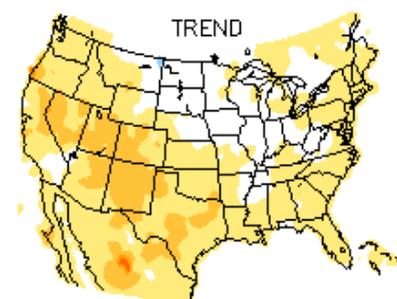
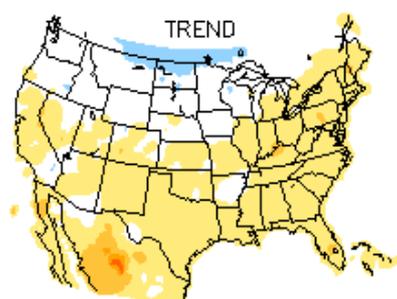
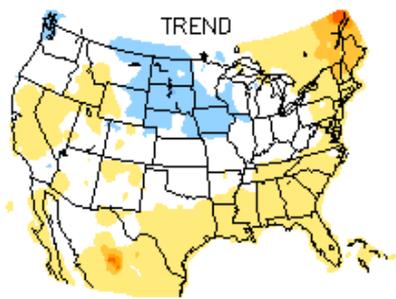
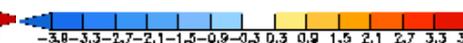
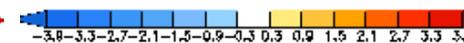
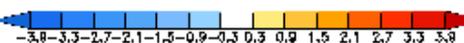
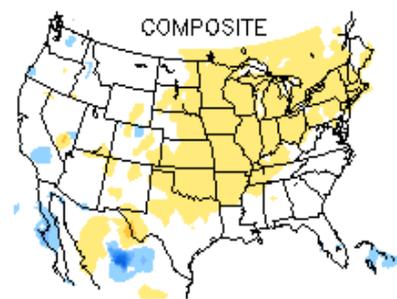
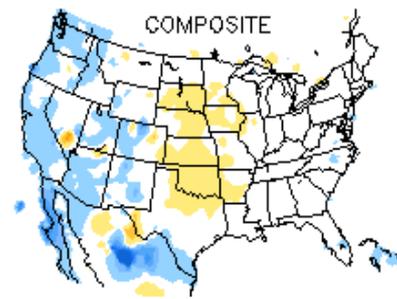
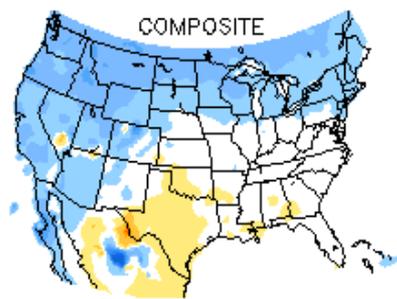
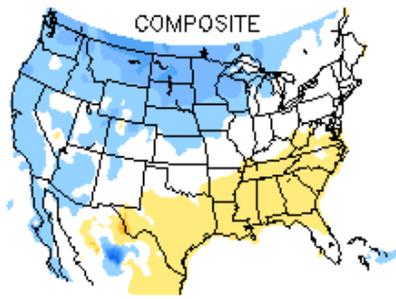
LA NINA Temperature COMPOSITES

DJF ANOMALIES

MAM ANOMALIES

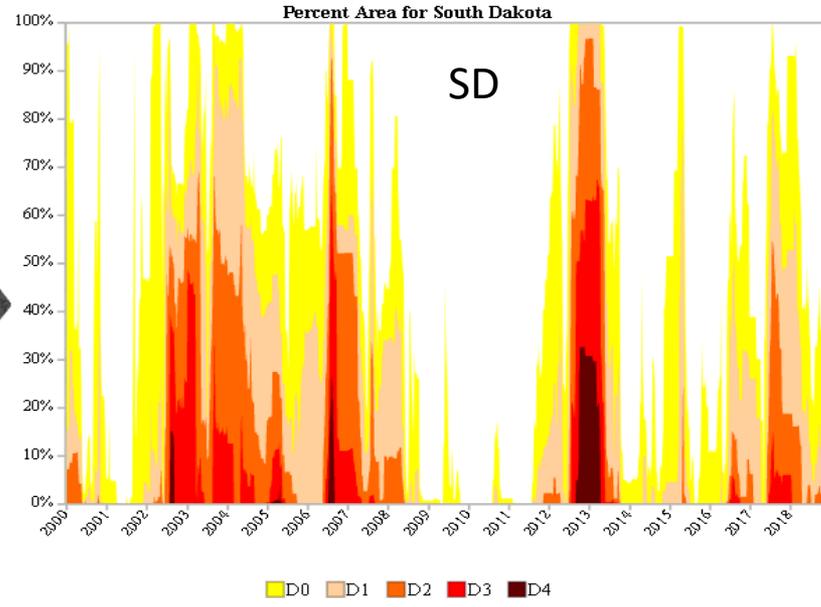
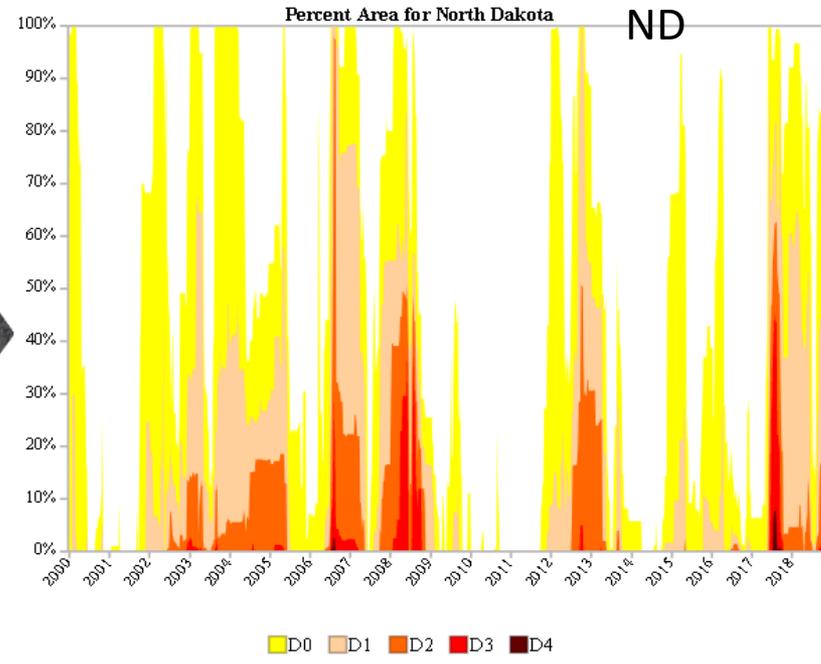
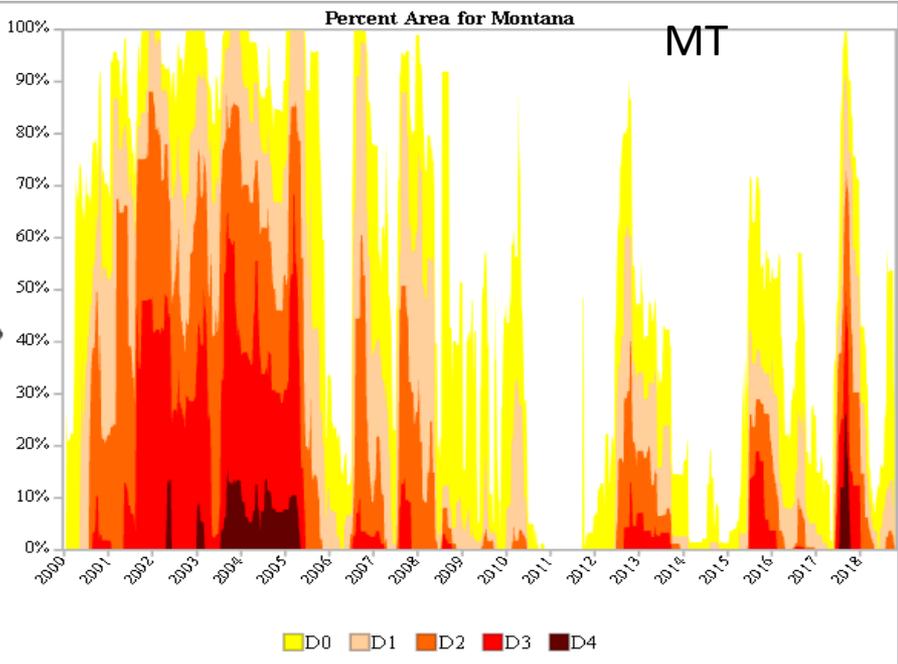
JJA ANOMALIES

SON ANOMALIES



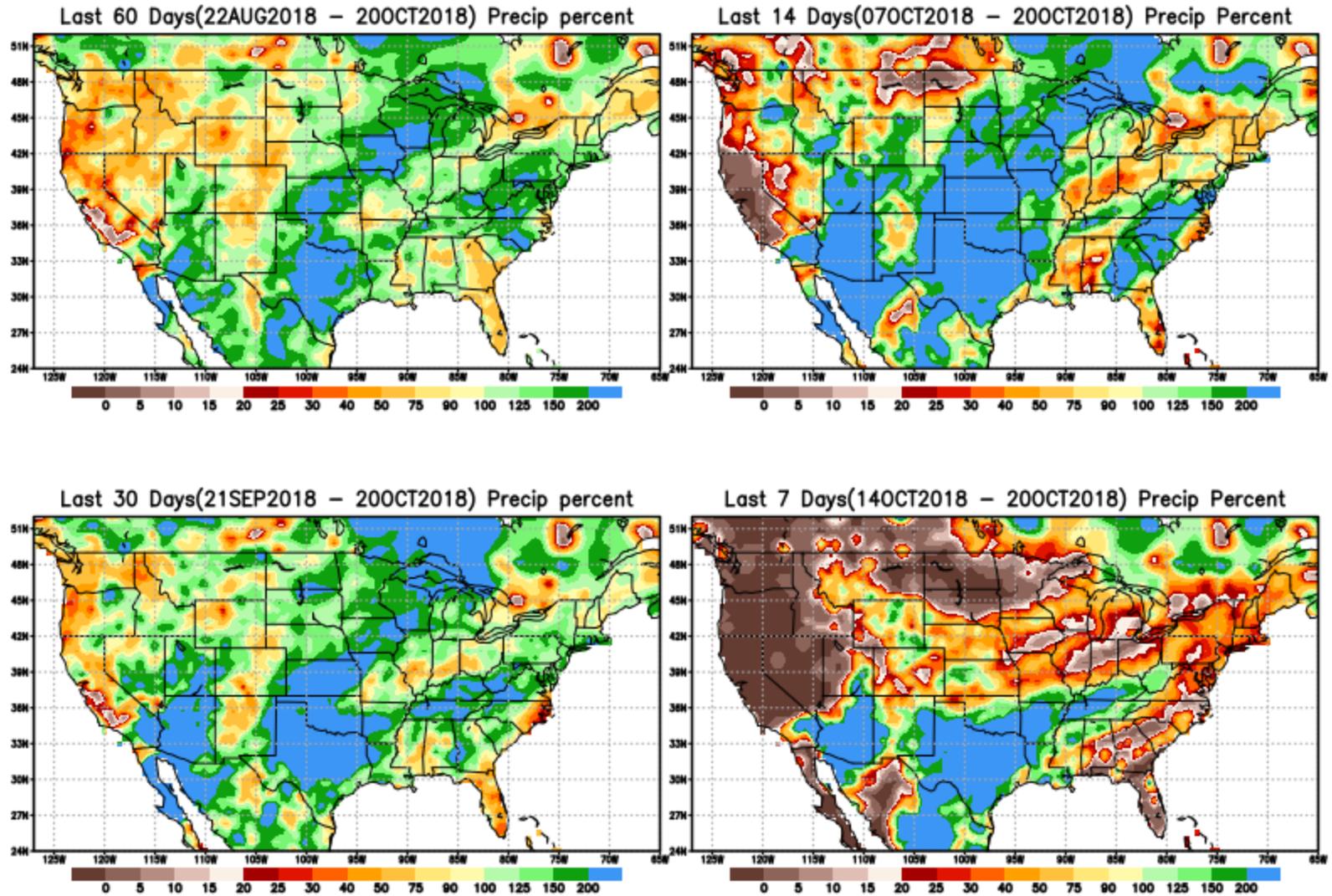
Percent of Drought areas (and categories) in states of Montana, North/South Dakotas)

(from www.drought.gov)



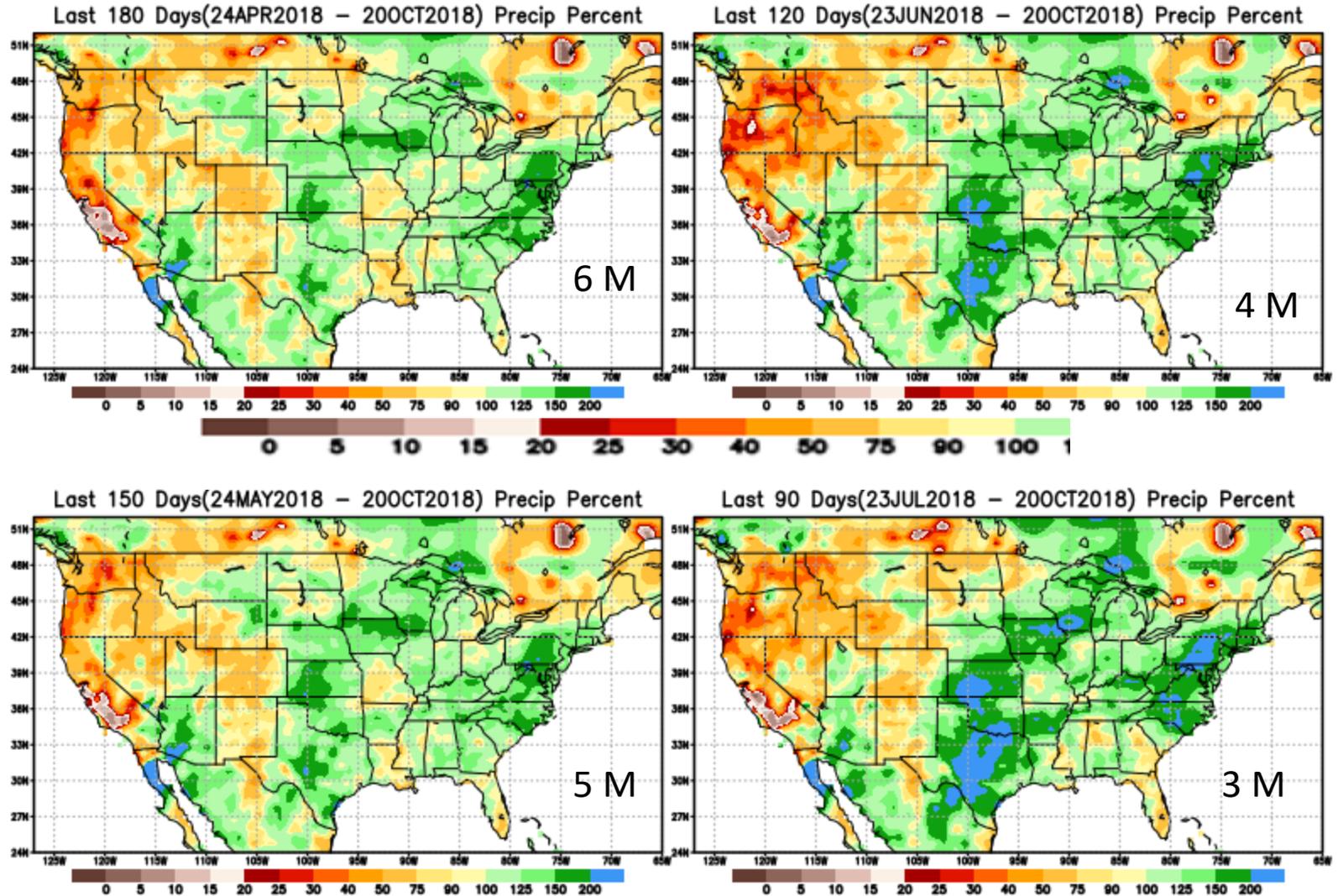
- Duration and Extent of recent droughts in the Northern High Plains since 2000.
- Not all these recent droughts affect these states the same way.
- Each drought is different in each state/region.

Percent of Precipitation received over several periods.



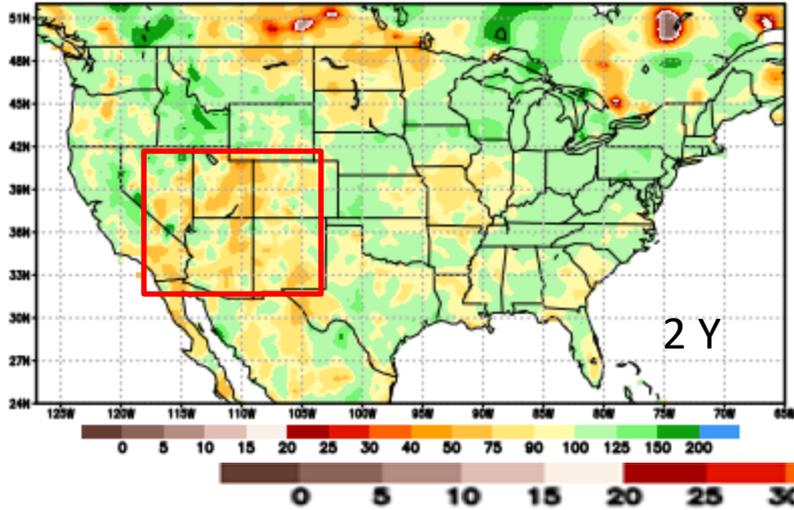
No need to panic if the expected rainfall did not happen for a given week, 2 weeks, or even a month! It all depends on what or how long/limited the rainfall season is for that region, and what the previous rainfall deficits have been and for how long!!

Percent of Precipitation received over several periods.

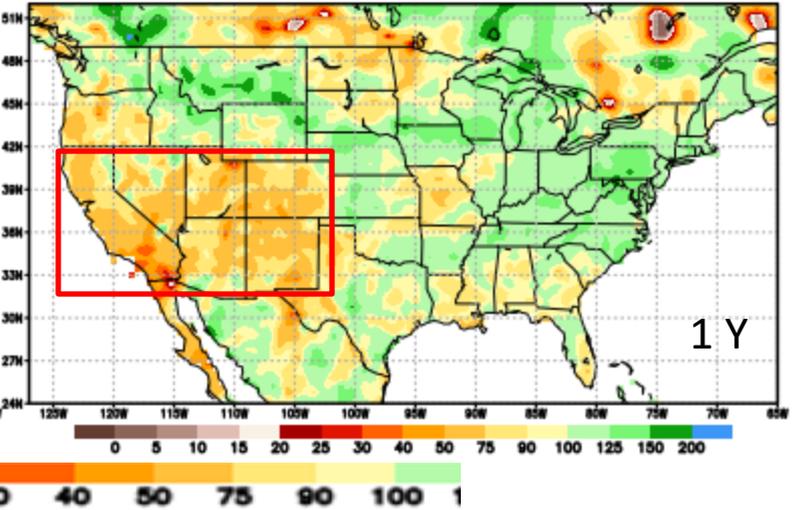


Percent of Precipitation received over several periods.

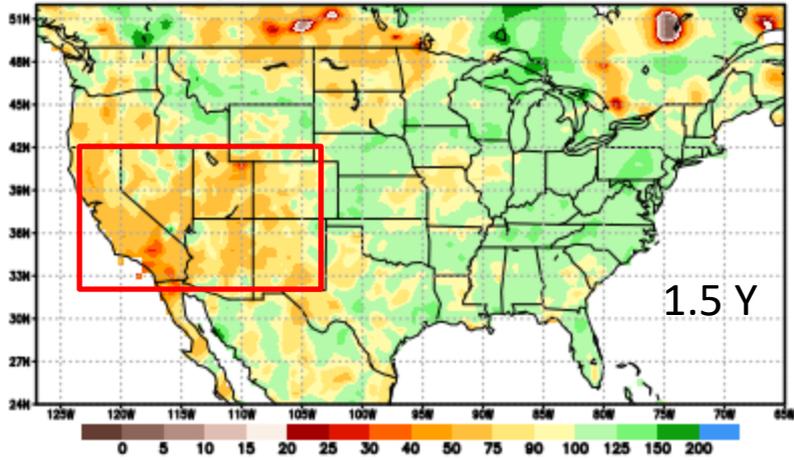
Last 2yr Days(21OCT2016 – 20OCT2018) Precip Percent



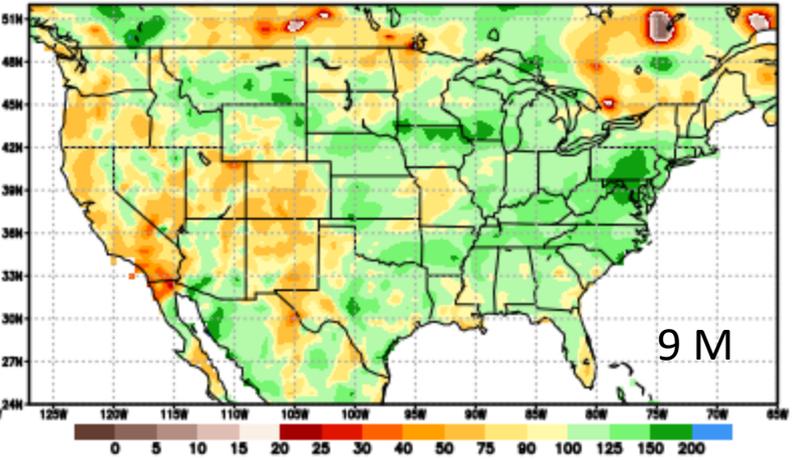
Last 1yr Days(21OCT2017 – 20OCT2018) Precip Percent



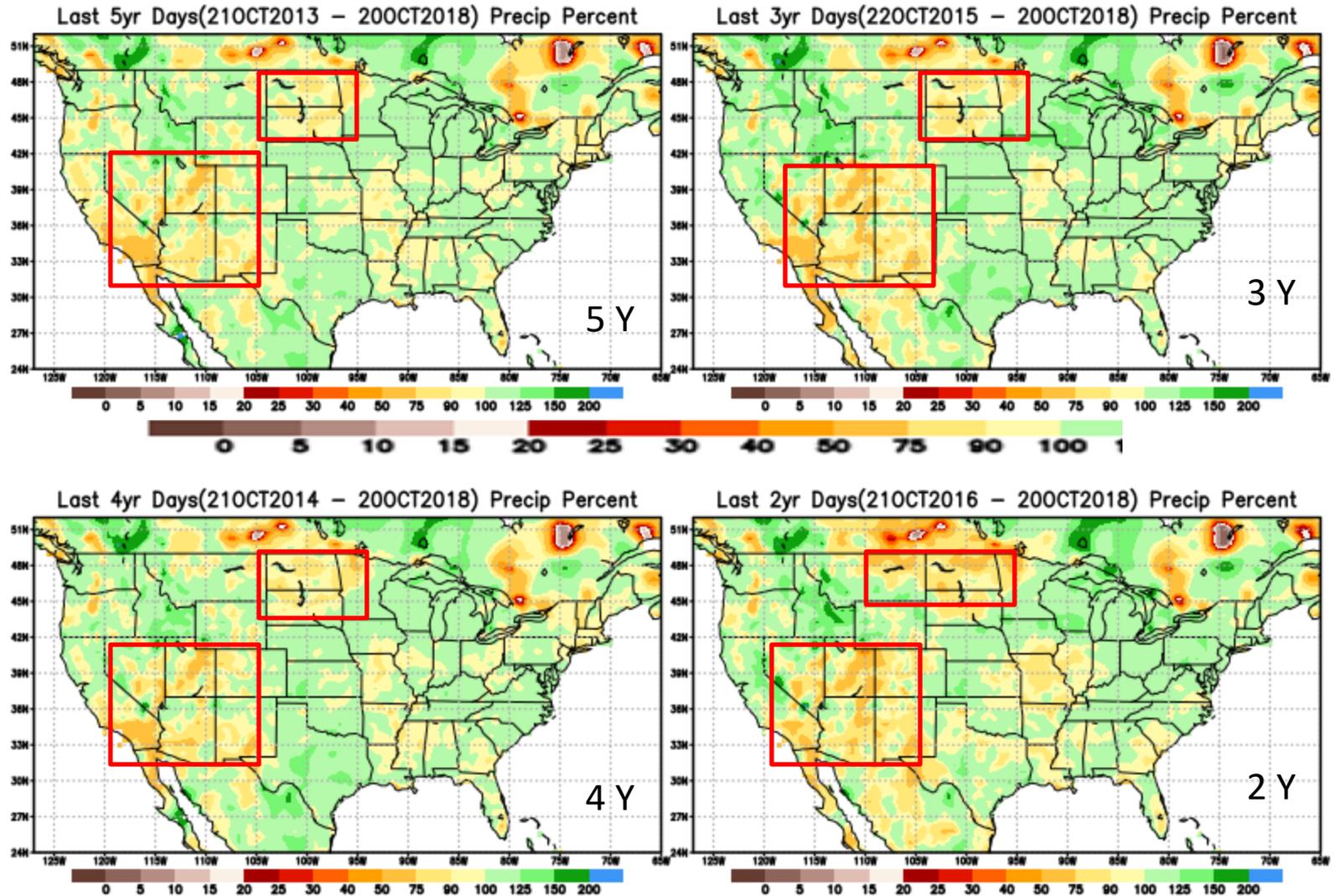
Last 1.5yr Days(21APR2017 – 20OCT2018) Precip Percent



Last 270 Days(24JAN2018 – 20OCT2018) Precip Percent



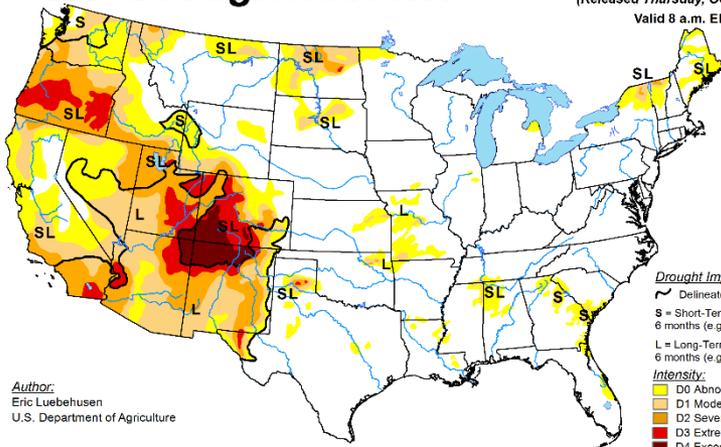
Percent of Precipitation received over several periods.



The latest US drought monitor will be released later today! 10/25/18 !(released every Thursday)

U.S. Drought Monitor

October 16, 2018
(Released Thursday, Oct. 18, 2018)
Valid 8 a.m. EDT



Author:
Eric Luebbehusen
U.S. Department of Agriculture

Drought Impact Types:

~ Delineates dominant impacts
S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)
L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

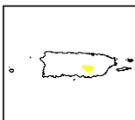
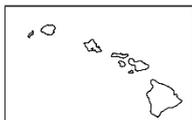
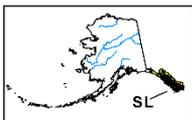
Intensity:

D0 Abnormally Dry
D1 Moderate Drought
D2 Severe Drought
D3 Extreme Drought
D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.



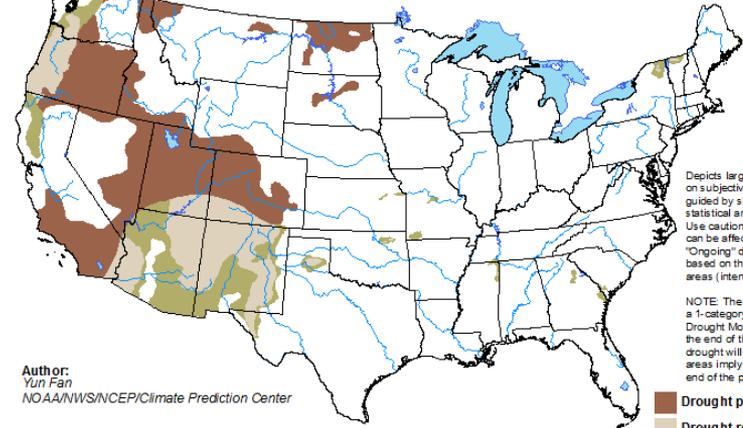
<http://droughtmonitor.unl.edu/>



Latest Seasonal Outlook.....

U.S. Seasonal Drought Outlook Drought Tendency During the Valid Period

Valid for October 18 - January 31, 2019
Released October 18, 2018



Author:
Yun Fan
NOAA/NWS/NCEP/Climate Prediction Center

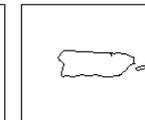
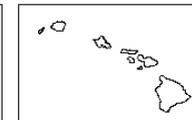
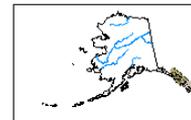
Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Use caution for applications that can be affected by short lived events. "Ongoing" drought areas are based on the U.S. Drought Monitor areas (intensities of D1 to D4).

NOTE: The tan areas imply at least a 1-category improvement in the Drought Monitor intensity levels by the end of the period, although drought will remain. The green areas imply drought removal by the end of the period (D0 or none).

Drought persists
Drought remains but improves
Drought removal likely
Drought development likely



<http://go.usa.gov/3eZ73>



In Summary.....

- So, what is the status of the two droughts, the Northern High Plains Drought & the Southwest Drought? Is the US Drought Monitor telling the whole story?
- These two droughts are likely carry the residual impacts of more than the most recent ENSO event, but more an accumulated impact of many recent ENSO events. One good normal rainy season may not necessarily be able to make up for these large deficits.
- It is important to monitor the rainfall shortfalls on many time scales, ranging from weeks to many years.
- While in the short term (month to season) the rainfall situation may appear well/satisfactory, longer term shortfalls may lurk in the background.